

Operating instructions

Rotary actuators

M135 • M140 • M150 • M180

General information

Proof of amendment

Version	Date	Changes
1.0	June 1998	Initial preparation
2.0	June 2012	Complete revision and supplements

Copyright

The copyright for this operating manual as well as all rights in case of patent awarding or registration of registered design remain with the manufacturer!

Subject to alterations

The regulations, directives, standards etc. are compliant with the current state of information at the time of development and are not subject to modification service. They must be applied by the operator at his own responsibility in their latest valid version.

Concerning all data, information, and illustrations in this manual we reserve the right of technical modifications and improvements. No claims can be considered for alteration or rework of already delivered rotary actuators.

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1 Safety

Please carefully read this operating manual and in particular the following safety notes prior to installation and operation.



DANGER

Immediately threatening risk which will result in death or serious injuries of the body.



WARNING

Potentially dangerous situation which might result in death or serious injuries of the body.



CAUTION

Potentially dangerous situation which might result in minor injury of the body. Indicates a risk which may be result in property damage.



ATTENTION

Potentially dangerous situation where the product or an object may be damaged in its environment.

Hint: Notes for application and other useful information.

1.1 Proper use

Rotary actuators M135, M140, M150, M180 are controlled by three-position controllers. The rotary actuators of the production series described herein are used to adjust flaps.

In order to ensure application for the purpose intended compare the above type designation for compliance with the nameplate of the rotary actuators prior to starting any action. The specifications on the type plate are standard for the technical data of the rotary actuators as well as the requirements for the public power supply.

Any use for purposes other than the intended as specified above, deviating tasks as well as operation at other than the admissible mains conditions shall be deemed application for purposes other than the intended. The owner shall be solely responsible for the risk to man and equipment as well as other assets when used for purposes other than the intended!

The intended use also includes the compliance with accident preventions, DIN VDE regulations and safe working practices for all measures described in these operating instructions in due consideration of prevailing rules.

1.2 For the owner-operator

Keep the operating manual always within reach at the place of operation of the rotary actuators!

Comply with the relevant applicable labor safety, accident prevention and DIN VDE regulation for installation, operation and maintenance.

Follow the additional regional, local or internal safety regulations, if any.

Make sure that any person entrusted to carry out one of the actions described in this operating manual has read and understood this manual.

1.3 Personnel

Only qualified personnel shall work at or near these rotary actuators. Qualified persons are deemed persons who are familiar with the installation, erection, start-up and operation and/or maintenance of the rotary actuators or have been qualified appropriately for their work. The necessary and prescribed qualifications include:

- Training / instruction or authorization to turn on /off circuits and appliances / systems according to EN 60204 (DIN VDE 0100 / 0113) and the standards of safety technology.
- Training or instruction according to the standards of the safety technology concerning care and use of adequate safety and work protection equipment.
- First Aid training.

Work safely and refrain from any mode of working which might in any way endanger the safety of persons or the rotary actuator and/or other assets.

1.4 Prior to work

Prior to any work check whether the types indicated here are in compliance with the information of the nameplate at the rotary actuator:

Rotary actuators M135, M140, M150, M180.

1.5 In operation

Safe operation is possible only if transport, storage, installation, operation and maintenance are carried out properly and in accordance with safety standards.

Transport, Installation and Assembly

Follow the general setup and safety regulations for heating, air-conditioning and pipeline construction. Use the tools properly. Wear the required personal protective equipment and other protective equipment.

Servicing and maintenance

Make sure that qualified personnel isolate the rotary actuator prior to maintenance or repair work according to DIN VDE.

1.6 Work environment

Note the information about the work environment as specified in the technical data.

2 Product Specification

Geared down by helical gears, the rotary motion of the reversible motor is transmitted to the actuator shaft, thus serving to move the connected fittings. Integrated slow-down limit position switches turn the motor off as soon as the set point of the slow-down limit position switch is reached.

2.1 Component parts

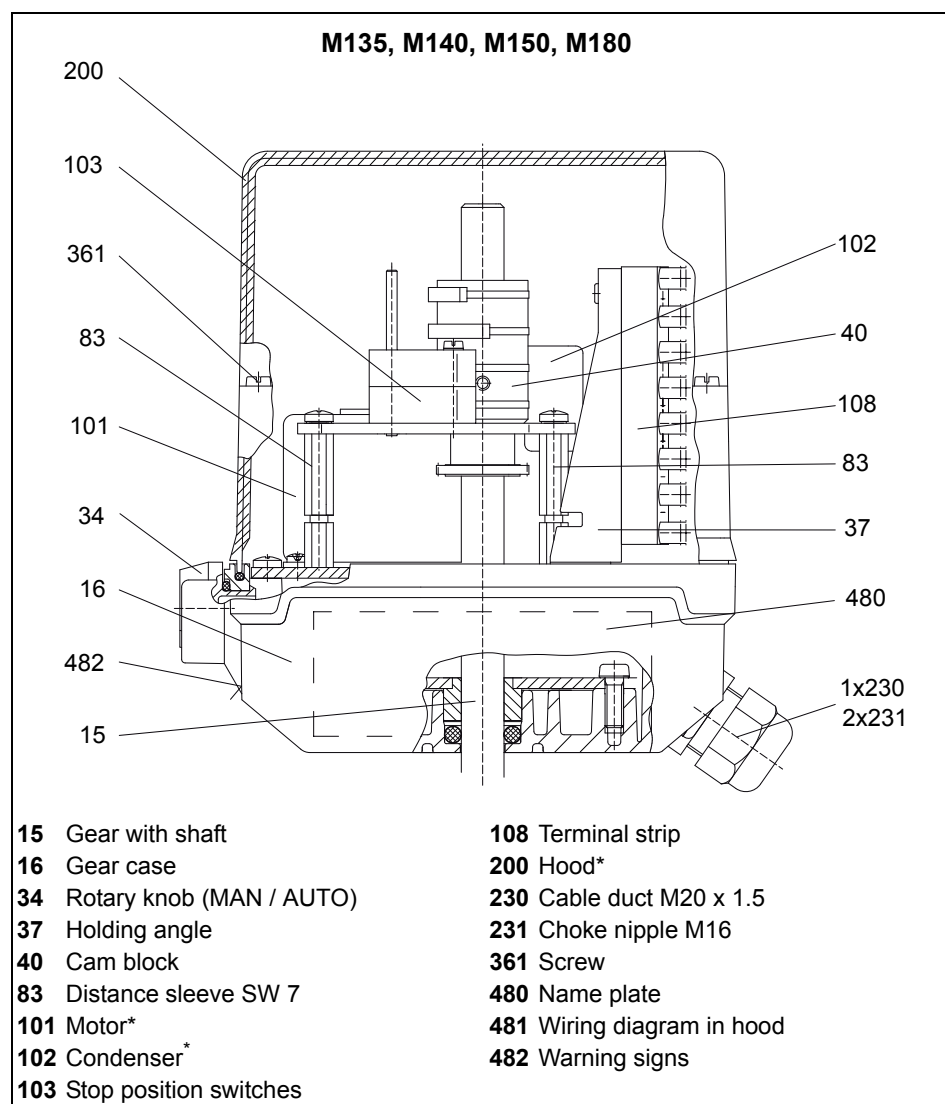


Fig. 1 Component part denominations

* This component part is available as a spare part!

2.2 Accessories

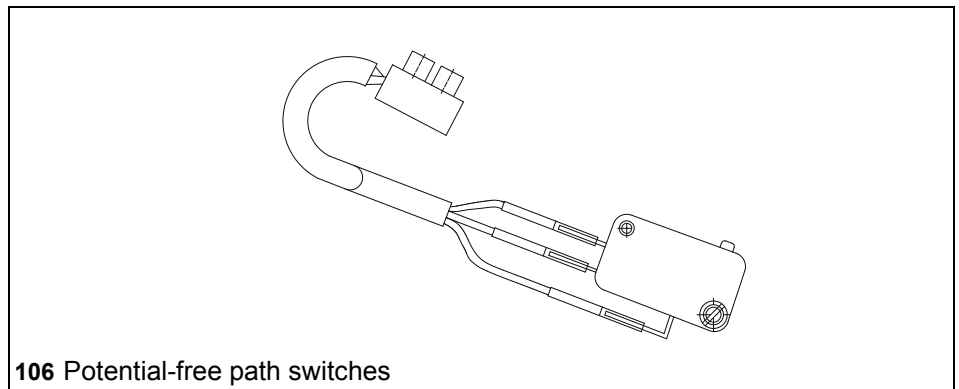


Fig. 2 Potential-free path switches

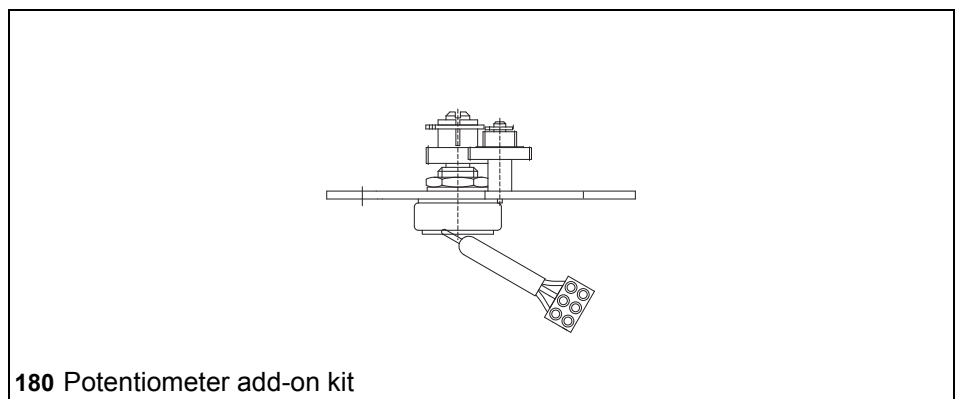


Fig. 3 Potentiometer add-on kit

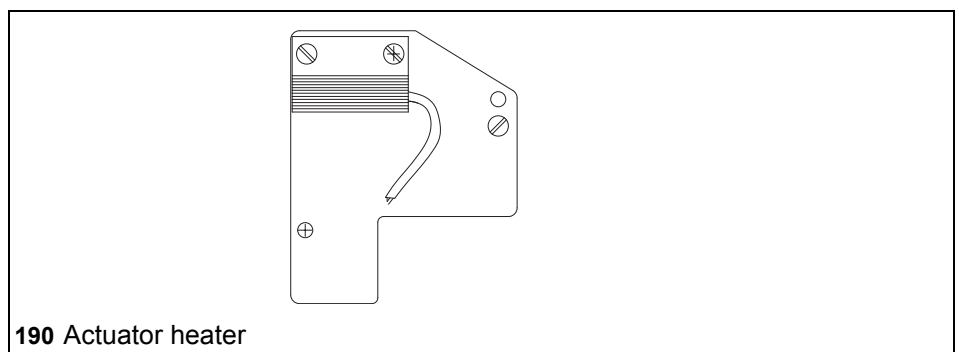


Fig. 4 Actuator heater

2.3 Operating modes

The rotary actuator can be operated manually or automatically. In manual mode the rotary motion is carried out with the help of the hand lever on the add-on kit.

- In automatic mode the rotary motion is electrically controlled.

2.3.1 Three-point mode

The direction of motion is set via the control voltage on terminal 2 and 3 on the terminal PCB:

- If the control voltage is applied to terminal 2 the actuator shaft will turn clockwise.
- If the control voltage is applied to terminal 3 the actuator shaft will move anti-clockwise.

2.4 Functions

2.4.1 Set time

The time in which the actuator shaft covers a distance of 90 degrees is called set time. Set time is specified in s/90°.

2.4.2 Manual operating

In manual mode you can change the rotary motion manually without supply voltage.

- In manual mode the supply voltage needs to be turned off by qualified staff.

6.1 Changing between manual and automatic mode on page 24

2.4.3 Potential-free path switch (accessory)

The optional path switch allows you (**106**) to set two actuating positions within which a potential-free contact is opened or closed.

5.2 Setting the potential-free path switches on page 21

2.4.4 Potentiometer (accessories)

The optional potentiometer (**180**) indicates the actual position of the rotary actuator. 0° Angles of rotation up to 90° are issued as:

- 0 ... 200 Ohm
- 0 ... 1 k Ohm
- 0 ... 10 k Ohm

5.3 Setting a potentiometer on page 22

2.4.5 Servo actuator heater (accessories)

The optional actuator heating (**190**) prevents the formation of condensation inside the actuator and ensures at the same time the ease of movement for the gear even at temperatures up to c. -20°C.

Heating capacity:

- 25 VA

2.5 Technical data

Type	M135, M150	M140, M180
Supply voltage:	230 V AC + 6% -10% 24 V AC \pm 10%	230 V AC + 6% -10% 24 V AC \pm 10%
Power consumption	M135 = 9 VA M150 = 12 VA	M140 = 55 VA M180 = 26 VA
Weight	2.5 kg	3 kg
Dimensions	See technical data sheets	
Frequency	50/60 Hz \pm 5%	50/60 Hz \pm 5%
Ambient temperature	0 to +50°C	0 to +50°C
Protection type	IP 54	IP 54
Operation mode	S1-100% ED	M140 = S3-50% ED M180 = S3-60% ED
Torque / Set time at 50 Hz	M135 = 35 Nm / 130 s/90° M135 = 15 Nm / 70 s/90° M150 = 50 Nm / 130 s/90° M150 = 40 Nm / 70 s/90°	M140 = 50 Nm / 10 s/90° M180 = 80 Nm / 130 s/90° M180 = 80 Nm / 70 s/90°
Input signal Y	Three-point	Three-point
Limit stop cut-off	Slow-down, infinitely variable max. 320°	

table 1 Technical data

2.6 Type plate

The type plate is attached to the housing of the rotary actuator.

It bears the type denomination, serial number (s/no) and date of manufacture (last four digits).

⇒ 2.1 *Component parts* on page 6


			
M135			
F.-Nr.: 11207991/01/1211			
AC 50 Hz	230 V	130 s / 90°	
IP 54	9 VA	35 Nm	
S1 100% ED			

Fig. 5 Example of type plate

3 Transportation & Storage



Non-compliance with safety regulations may result in injury!

- Wear the required personal and other safety equipment.
- Avoid impacts, blows, vibrations etc. to the rotary actuator.
- Store the rotary actuator (and, where appropriate, the entire controlling device) in a dry place.
- Keep to the specified transport and storage temperatures between -20 to +65° C.

4 Assembly

Prior to installing a rotary actuator:

⇒ 4.1 *Checking the scope of delivery* on page 11

⇒ 4.2 *Preparing assembly* on page 11

The following sequence of operations is part of the rotary actuator assembly:

⇒ 4.3 *Mount rotary actuator on flap* on page 12

⇒ 4.4 *Assembling/disassembling a hood* on page 13

⇒ 4.5 *Electrical connection* on page 14

4.1 Checking the scope of delivery

- 1 Check the packaging for damage.
- 2 Dispose of packaging in an environmentally friendly manner.
- 3 Check the delivered items against the delivery note in order to see whether the delivery is complete.
- 4 Report any missing or damaged products to the manufacturer.

4.2 Preparing assembly

- 1 Allow for about 160 mm space above the hood at the site of installation.
- 2 Check the working environment before assembling and commissioning the rotary actuator.
- 3 Ensure that the flap is installed correctly. For details please refer to the installation instruction for the flap.
- 4 Do not arrange rotary actuators in a suspending arrangement.

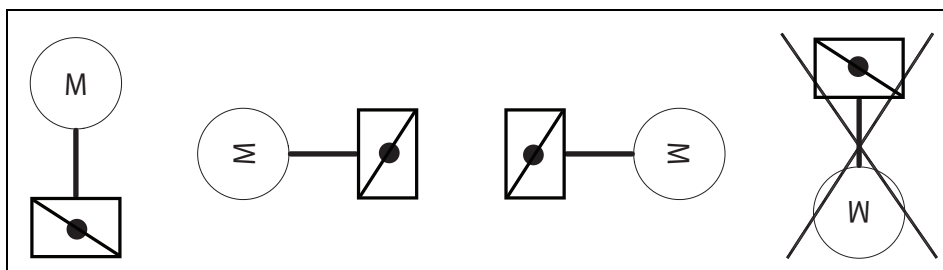


Fig. 6 Assembly position

4.3 Mount rotary actuator on flap

If rotary actuator and flap are supplied as separate deliveries you will have to mount the rotary actuator on the flap.

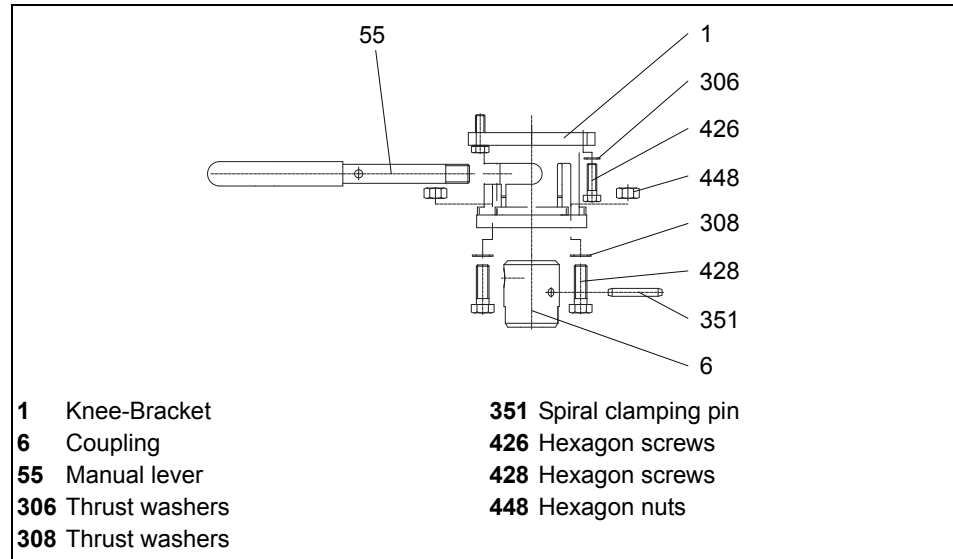


Fig. 7 Add-on kit for flaps

■ How to assemble a rotary actuator

- 1 Secure the coupling (6) to the actuator shaft with pins using the spiral pin (351)
- 2 Attach the knee (1) below the actuator with the four hexagon screws (426), using spanner width 10 and thrust washers (306) applying a torque of 5 Nm.
- 3 Turn the hand lever (55) into the coupling (6).
- 4 Put the actuator with add-on kit on the flap.
- 5 Insert the four hexagon nuts (448) in the slots of the knee (1).
- 6 Insert the hexagon screws (428) spanner width 13 and slipped on thrust washers (308) from below through the flap flange.
- 7 Connect the four hexagon screws (428) spanner width 13 to the hexagon nuts (448) applying a torque of 7 Nm.

■ How to disassemble a rotary actuator

- 1 Follow the sequence of operation in reverse order.

4.4 Assembling/disassembling a hood

The terminals for electric connection are positioned under the hood.



Risk of injury from electric shock by live parts!

When the power supply is on there is a danger of electric shock due to live parts.

- Prior to commencing any work, ensure that the actuator is safely disconnected from the power supply system.
- Secure against unauthorised restarting.
- Remove the hood only temporarily.

■ Remove the hood

- 1 Detach the screws.(361)
- 2 Carefully remove the hood (200) .

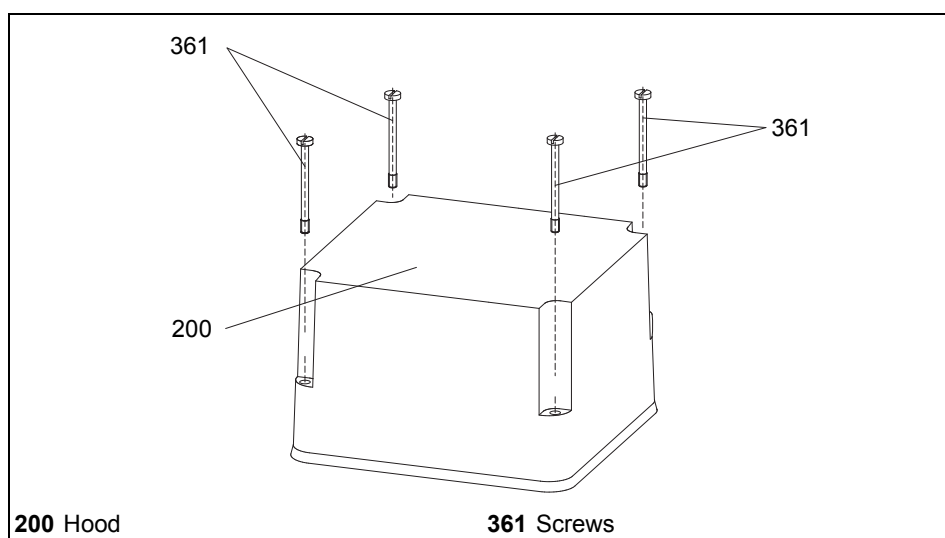


Fig. 8 Remove the hood

■ How to put the hood back on

- 1 Put the hood (200) back on.
- 2 Check the hood for correct fit to ensure air-tightness for the actuator housing.
- 3 Secure the hood with screws (361).

4.5 Electrical connection



Danger of life caused by incompetent staff!

Electrical connections carried out by unqualified staff may result in death, severe bodily injury or considerable material damage.

- Make sure that such all work is carried out by qualified staff.

⇒ 1.3 *Personnel* on page 5



Risk of injury from electric shock by live parts!

When the supply voltage is turned on there is a risk of electric shock from live parts.

- Prior to commencing any work, ensure that the actuator is safely disconnected from the power supply system.
- Secure against unauthorised restarting.

■ How to prepare the electric connection

- 1 Ensure that the supply voltage matches the specifications on the type plate of the rotary actuator.
- 2 To avoid breakdown, construct the line diameter according to actuating performance and required line length.
- 3 Check the supply voltage.
If the required tolerance is not achieved by a power transformer you will have to use an AC voltage stabilizer.
⇒ 2.5 *Technical data* on page 9

■ How to establish electrical connection

- 1 Remove the hood (200).
⇒ *Remove the hood* on page 13
- 2 Guide the cable through the cable duct in the transmission case to the terminal strip.
- 3 Connect the power supply according to the wiring diagram.
⇒ *Fig. 9 Wiring diagram* on page 15

Hint: The wiring diagram (481) is positioned on the inside of the hood (200).

- 4 Tighten the screw joint.



Malfunction due to parallel circuit

- The connection of several actuators via one output contact is prohibited!
- One coupling relay per actuator must be provided if several actuators are to be run on a parallel circuit!

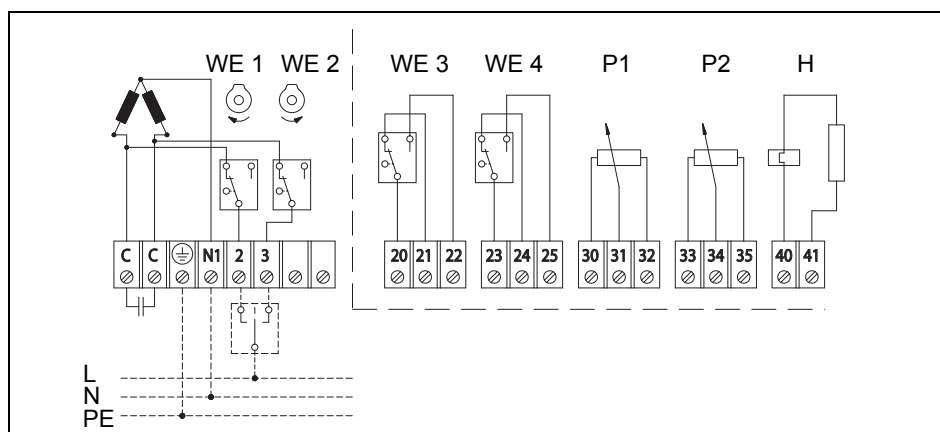


Fig. 9 Wiring diagram


Terminal	Description
PE / 	Protective conductor
N1	Supply voltage:
2	Control voltage for rotary motion anti-clockwise
3	Control voltage for rotary motion clockwise
20, 21, 22	Terminals path switch unit WE 3
23, 24, 25	Terminals path switch unit WE 4
30, 31, 32	Terminals potentiometer P1
33, 34, 35	Terminals second potentiometer P2
40, 41	Terminals actuator heater

table 2 Key to wiring diagram

4.6 Fitting accessories

Accessories are not part of the scope of delivery for the rotary actuator unless expressly ordered! The rotary actuators are prepared for retro-fitting with:

- Path switch (**106**)
 - Potentiometer (**180**)
 - Actuator heater (**190**)
- ⇒ 2.2 Accessories on page 7

4.6.1 Fitting path switches WE 3 and WE 4



Risk of injury from electric shock by live parts!

When the supply voltage is turned on there is a risk of electric shock from live parts.

- Prior to commencing any work, ensure that the actuator is safely disconnected from the power supply system.
- Secure against unauthorised restarting.

- 1 Remove the hood (**200**).
⇒ 4.4 Assembling/disassembling a hood on page 13
- 2 Remove slotted screw M3 x 25 (**393**) and thrust washer.
- 3 Put path switches WE 3 (**45.3**) and WE 4 (**45.4**) on pin (**350**).
- 4 Secure path switches WE 3 (**45.3**) and WE 4 (**45.4**) with slotted screw M3 x 45 (**393**) and thrust washer.
- 5 Run the cables for the path switches to the angle bracket.
- 6 Secure the terminals for the pacam diskth switches with the slotted screws on the angle bracket at terminal designations 20, 21, 22 and 23, 24, 25.
⇒ Fig. 9 Wiring diagram on page 15
- 7 Set the path switches.
⇒ 5.2 Setting the potential-free path switches on page 21

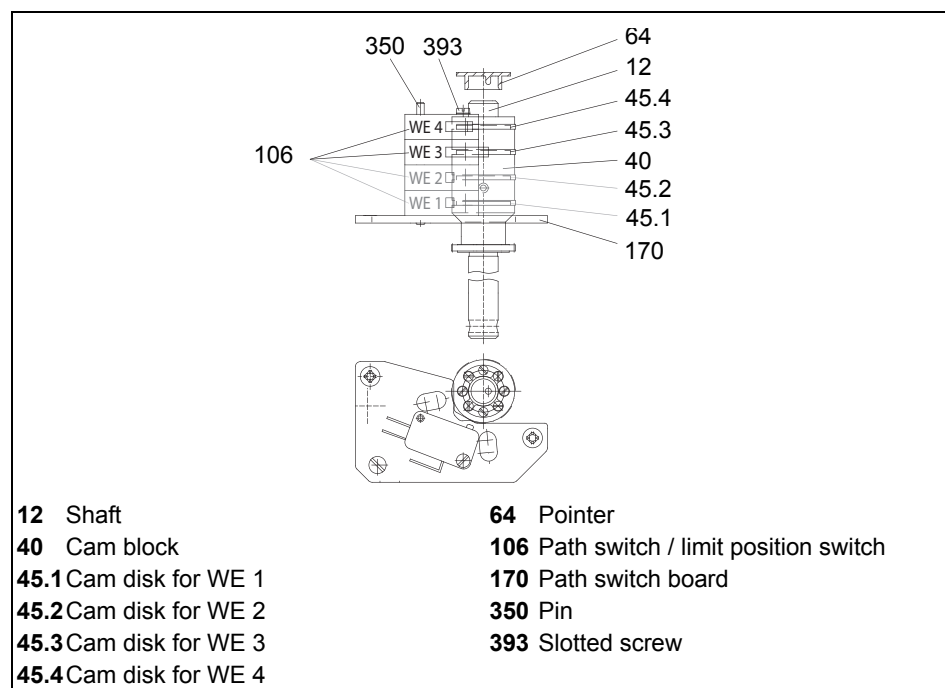


Fig. 10 Fit path switch

4.6.2 Fitting a potentiometer



Risk of injury from electric shock by live parts!

When the supply voltage is turned on there is a risk of electric shock from live parts.

- Prior to commencing any work, ensure that the actuator is safely disconnected from the power supply system.
- Secure against unauthorised restarting.

- 1 Remove the hood **(200)**.
⇒ 4.4 Assembling/disassembling a hood on page 13
- 2 Attach the potentiometer board **(180)** with slits in the recess of the hexagon sleeves underneath the path switch using slotted screw **(394)** M4 x 20 and thrust washers.

Hint: Ensure correct meshing of gears.

- 3 Run the cable for the potentiometer to the angle bracket.
- 4 Secure the terminals of the path switch with the slotted screws on the angle bracket at terminal designations 30, 31, 32.
⇒ Fig. 9 Wiring diagram on page 15
- 5 Set the potentiometer.
- 6 5.3 Setting a potentiometer on page 22

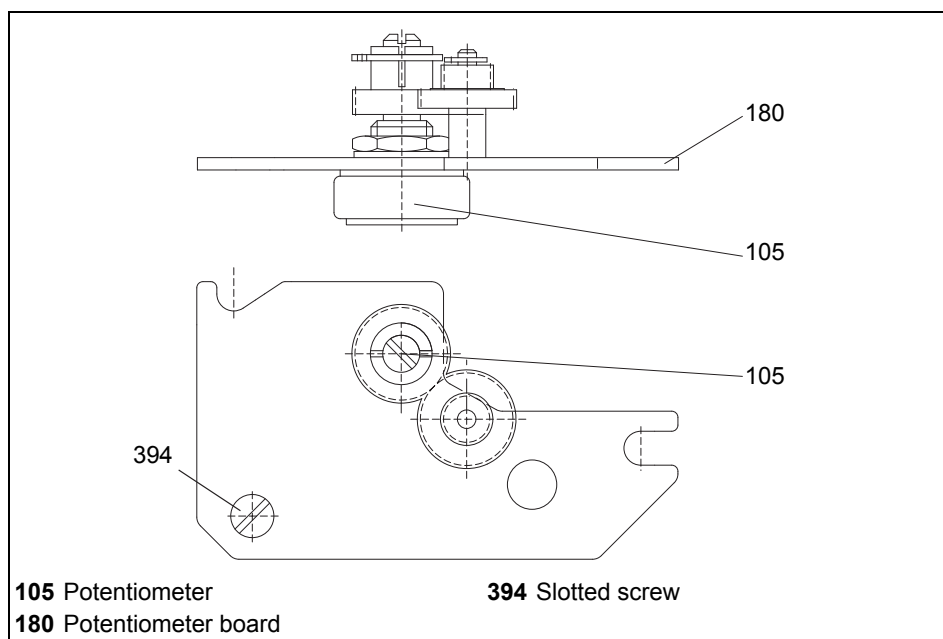


Fig. 11 Fitting a potentiometer

4.6.3 Fitting the actuator heater



Risk of injury from electric shock by live parts!

When the supply voltage is turned on there is a risk of electric shock from live parts.

- Prior to commencing any work, ensure that the actuator is safely disconnected from the power supply system.
- Secure against unauthorised restarting.

- 1 Remove the hood (**200**).
⇒ 4.4 Assembling/disassembling a hood on page 13
- 2 Remove the slotted screw and screw down the distance sleeve.
- 3 Secure the actuator heater (**190**) on the distance sleeves with slotted screws M4 x 8 and thrust washers.
- 4 Run the cable for the actuator heater to the angle bracket.
- 5 Secure the terminals for the actuator heater with slotted screws on the angle bracket at terminal designations 40, 41.
⇒ Fig. 9 Wiring diagram on page 15

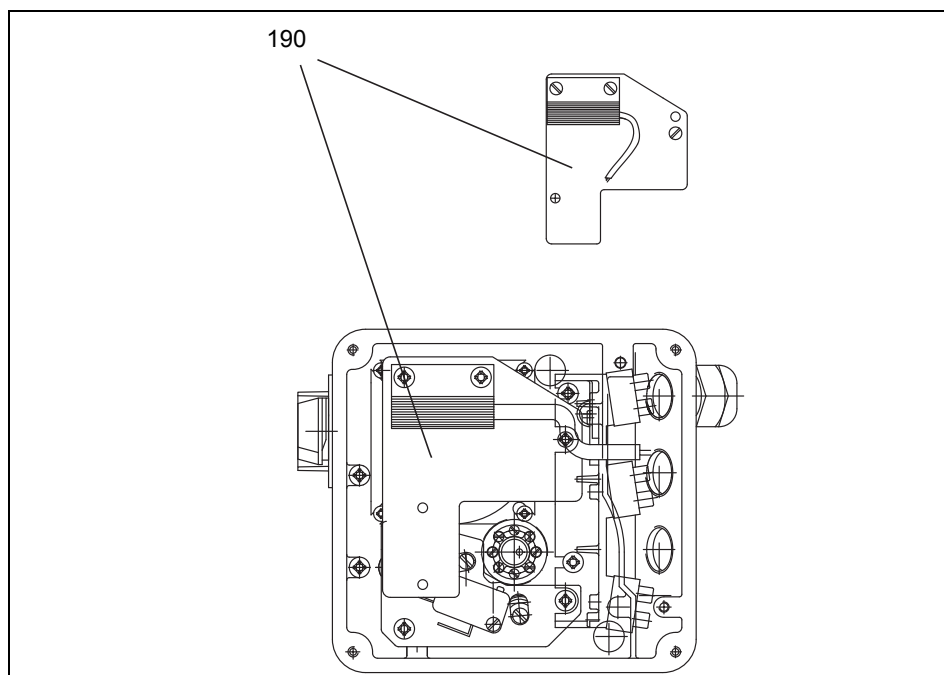


Fig. 12 Fitting the actuator heater

5 Commissioning



Risk of injury from electric shock by live parts!

When the power supply is on there is a danger of electric shock due to live parts.

- Prior to commencing any work, ensure that the actuator is safely disconnected from the power supply system.
 - Secure against unauthorised restarting.
-



Risk of damage to device when adjusted manually

The actuator may sustain damage if the rotary actuator is not disconnected from the power supply.

- Disconnect actuator from power supply.
-

- 1 Ensure that the hood **(200)** is mounted.
- 2 Turn the rotary knob to **(34)** AUTO position.
- 3 Make sure that the motor is turned off in the end positions (limit position switch).
⇒ 5.1 Setting a limit position switch on page 20

5.1 Setting a limit position switch

You need to set the limit position switch before you can take the rotary actuator into operation. Set the two limit position switches separately. Try out the sequence of operations for each limit position switch once.



Risk of damage from incorrectly set limit position switches

The limit position switches WE 1 and WE 2 turn off the motor in a path-dependant way.

Do not change the factory setting if the actuator is delivered together with the flap.

- If actuator and flap are delivered separately, set the limit position switches WE 1 (direction of rotation clockwise) and WE 2 (direction of rotation anti-clockwise).

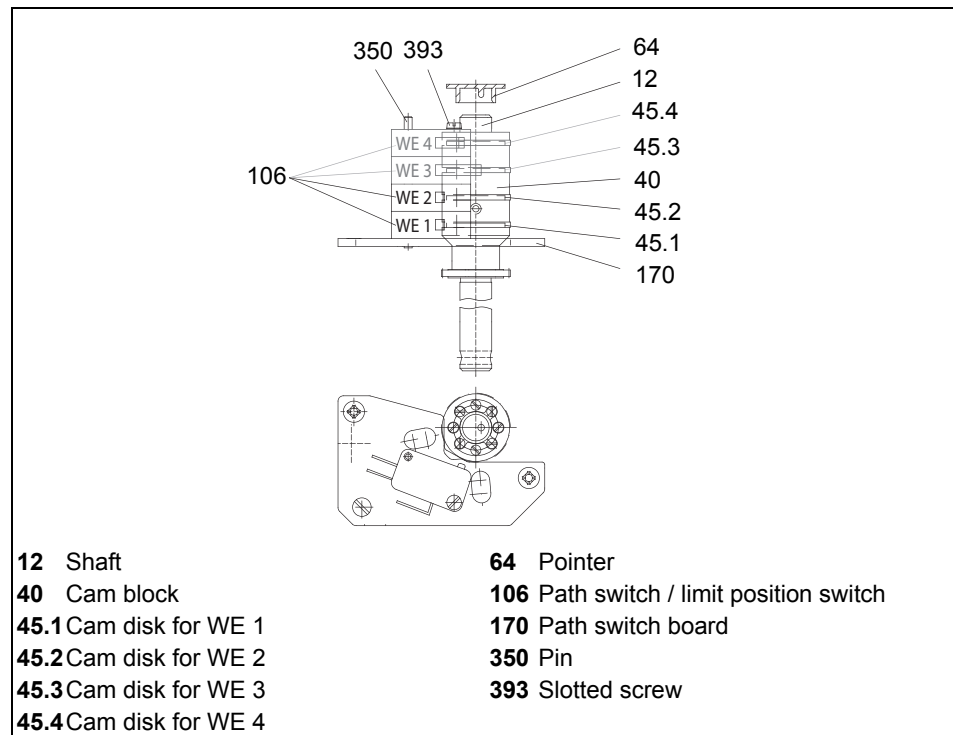


Fig. 13 Setting limit position switch

Hint: The cam disks (45.1) to (45.4) inside the cam block (40) can be adjusted separately. The pairs of screws are allocated to each cam ring by height.

■ How to set limit position switches WE 1 and WE 2



Risk of injury from electric shock by live parts!

When the supply voltage is turned on there is a risk of electric shock from live parts.

- Take care not to touch any live parts.

- 1 Remove the hood (200).
⇒ 4.4 Assembling/disassembling a hood on page 13
- 2 Pull off the pointer (64) off the shaft (12).
- 3 Remove the respective pair of screws.
- 4 Move the actuator in the respective end position.

- 5 Turn off the motor.
- 6 Turn the cam disk until the path switch switches.
- 7 Tighten the respective pair of screws.
- 8 Slip the pointer **(64)** on the shaft **(12)**. Ensure that the pointer's locking pin engages with the designated drilled hole in the shaft.

5.2 Setting the potential-free path switches

Set the two path switches separately. Try out the sequence of operations for each path switch once.

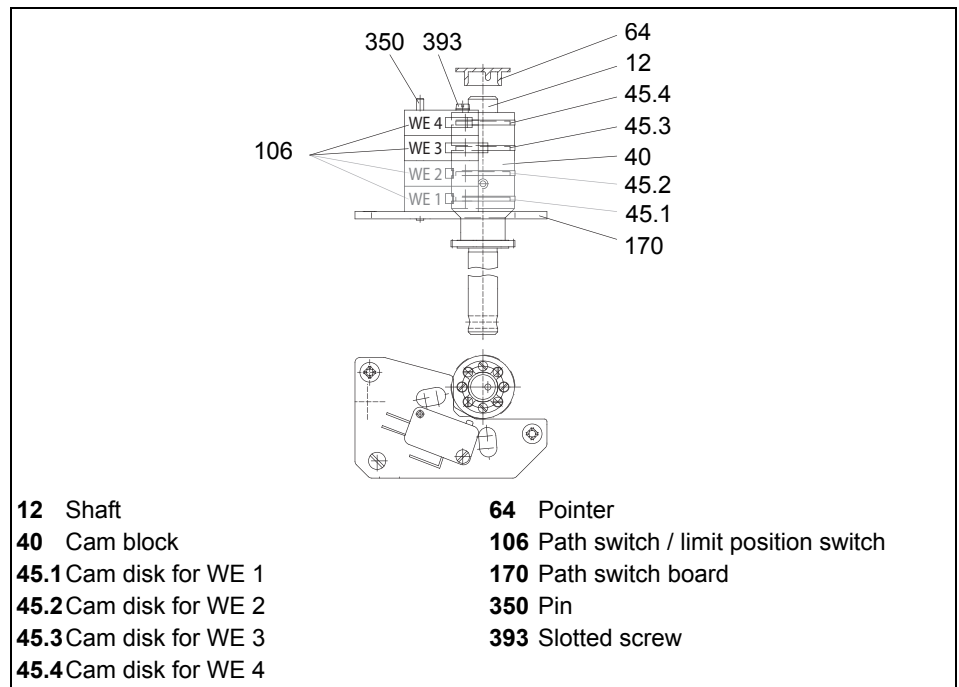


Fig. 14 Setting path switches

Hint: The cam disks **(45.1)** to **(45.4)** inside the cam block **(40)** can be adjusted separately. The pairs of screws are allocated to each cam ring by height.

■ How to set potential-free path switches



Risk of injury from electric shock by live parts!

When the supply voltage is turned on there is a risk of electric shock from live parts.

- Take care not to touch any live parts.

- 1 Remove the hood **(200)**.
⇒ 4.4 Assembling/disassembling a hood on page 13
- 2 Pull off the pointer **(64)** off the shaft **(45.1)**.
- 3 Remove the respective pair of screws.
- 4 Move the actuator, either manually or electrically, into the desired position.
- 5 Turn off the motor.
- 6 Turn the cam disk until the path switch switches.
- 7 Tighten the respective pair of screws.

- 8 Slip the pointer (64) on the shaft(12). Ensure that the pointer's locking pin engages with the designated drilled hole in the shaft.

5.3 Setting a potentiometer

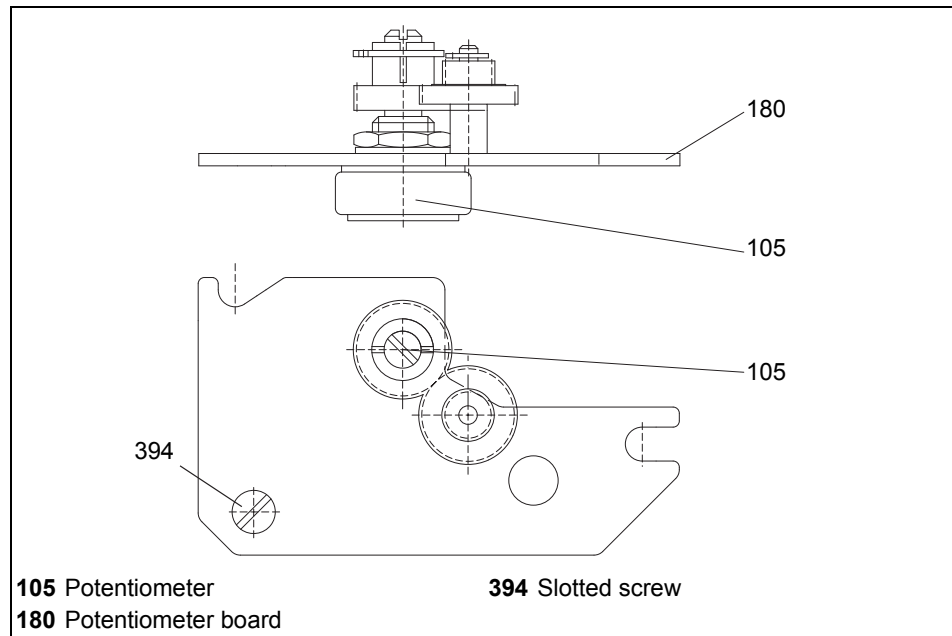


Fig. 15 Setting a potentiometer

■ How to set a potentiometer



Risk of injury from electric shock by live parts!

When the supply voltage is turned on there is a risk of electric shock from live parts.

- Take care not to touch any live parts.

- 1 Remove the hood (200).
⇒ 4.4 Assembling/disassembling a hood on page 13
- 2 Move the actuator electrically into end position (closed flap).
- 3 Observe the rotary motion of the potentiometer axle.
- 4 Carefully rotate the potentiometer axle with the help of a screwdriver up to the stop in the fixed direction of rotation.

5.4 Commissioning

- 1 Check whether all fitting and assembly work has been competently finished.
⇒ 4 *Assembly* on page 11
- 2 Ensure that the actuation of the rotary actuator can take place safely without putting people or devices at risk.
- 3 Ensure that the rotary actuator is attached correctly and that the rotary actuator's hood is closed.
⇒ 4.4 *Assembling/disassembling a hood* on page 13
- 4 Ensure that the rotary actuator is set to automatic mode.
⇒ 6.1 *Changing between manual and automatic mode* on page 24
- 5 Ensure that the final position switches are set correctly.
⇒ 5.1 *Setting a limit position switch* on page 20
- 6 Apply supply voltage. The rotary actuator is ready for operation.

6 Operation

6.1 Changing between manual and automatic mode

Manual adjustment is possible when combined with a suitable add-on kit.

■ How to change-over in manual mode

- 1 Disconnect the actuator from the power supply.



Risk of damage to device when adjusted manually

The actuator may sustain damage if the rotary actuator is not disconnected from the power supply.

- Disconnect actuator from power supply.

- 2 Turn the rotary knob (34) to MAN position.



Risk of damage to flap and actuator during manual mode!

The flap may get damaged if it is pushed too hard into its receptacle during manual mode.

- Stop operating the hand lever when the physical effort required increases noticeably.
- Never use force !

- 3 Adjust the flap with the help of the hand lever.

■ How to change into automatic mode

- 1 Turn the rotary knob to (34) AUTO position.
- 2 Operate the hand lever until the gear engages.
- 3 Turn on the power supply.

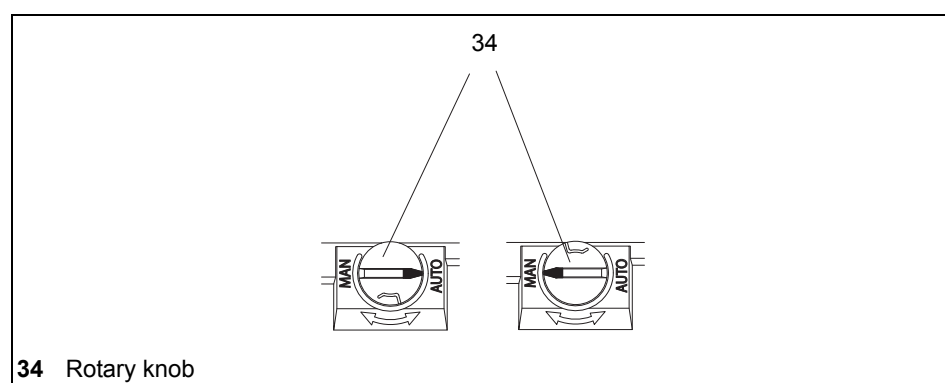


Fig. 16 Operating mode selection MAN / AUTO

7 Maintenance, care and repairs

The rotary actuator is low-maintenance. You do not have to carry out continuous or periodical maintenance.

8 Spare parts

When ordering accessories and spare parts please quote the specifications engraved on the type plate of your rotary actuator. The specifications on the type plate are standard for the technical date of the rotary actuators as well as the requirements for the public power supply.



ATTENTION

Damage to device caused by faulty spare parts!

Spare parts must match the technical data specified by the manufacturer.

- Use genuine spare parts at all times.

⇒ 2.1 Component parts on page 6

⇒ 2.2 Accessories on page 7

9 Decommissioning and disposal

Dispose of the rotary actuator according to national regulations and laws.

10 Removal of faults

10.1 How to remedy faults

If the rotary actuator does not work properly follow the sequence of operations described below in order to remedy the fault:

- 1 Check whether the rotary actuator was correctly assembled.
- 2 Check the settings for the rotary actuator against the specifications on the type plate.
- 3 Remedy the fault by following the check list.
⇒ 10.2 Check list for breakdown on page 26
- 4 If you are unable to remedy the fault contact the manufacturer.
- 5 For all queries at the manufacturer's and when sending back the device please quote the following :
 - SN (serial number = order number)
 - Type denomination
 - Supply voltage and frequency
 - Accessory equipment
 - Error report
- 6 If you are unable to remedy the fault despite inquiry you can send the device to the manufacturer.

10.2 Check list for breakdown

Fault	Cause	Rectification
1. Rotary actuator is not working.	Rotary knob is in MAN position instead of AUTO	<input type="checkbox"/> Turn rotary knob to AUTO position, engage mechanism.
	Power cut	<input type="checkbox"/> Determine cause and remedy.
	Fuse defective (in control cabinet)	<input type="checkbox"/> Determine cause and remedy, replace fuse.
	Rotary actuator is connected incorrectly	<input type="checkbox"/> Set connection correctly according to wiring diagram (in the cover).
	Short circuit due to incorrect connection	<input type="checkbox"/> Correct setting for connection
	Motor has winding damage (burnt-out) • e.g. voltage too high	<input type="checkbox"/> Determine cause, measure current data, Compare to type plate and table, Disassemble rotary actuator and send it in for repair.
2. Rotary actuator running unsteadily, i. e. veering between clockwise and anti-clockwise rotation.	Drop of voltage due to excessively long connecting cables and / or insufficient diameter.	<input type="checkbox"/> Measure the current data on the rotary actuator; if required, re-calculate and replace connecting cables!
	Public power supply fluctuations greater than admissible tolerance ⇒ 2.5 <i>Technical data</i> on page 9	<input type="checkbox"/> Improve public power supply conditions
3. Rotary actuator temporarily interrupted.	Slack contact in feeder line	<input type="checkbox"/> Check and tighten connections (terminal strips)
4. Rotary actuator is not moving to end positions. Flap is not closing/opening.	End limit position switch incorrectly set	<input type="checkbox"/> Readjust limit position switch
	Motor run capacitor defective	<input type="checkbox"/> Replace capacitor
	Excessive system pressure	<input type="checkbox"/> Adjust system pressure
	Foreign object in flap	<input type="checkbox"/> Remove foreign object and clean flap

table 3 Check list breakdown